

D^{*}lnu selections, productions and QA

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SLAC

Selection processes

The analysis includes several stages before producing final ASCII files for lifetime and mixing fitting.

- Expedited skim data based on "old" dstarlnu tag-bit (16.67 on-peak + 2.36 off-peak fb^{-1})
- Create ntuples with events passing **B0ToDstarlnuVTight** (with DstarlnuUser, no vertexing, no D^*l refitting)
- Apply cuts that is close to final and make time stamps
- Create reduced collections from the time stamps
- Create ntuples with events passing **B0ToDstarlnuVTight** (with updated DstarlnuUser, with vertexing and D^*l refitting)
- Run a kumac through ntuples with final cuts, create ASCII files.
- For MC, only the last two bullets are applied.

Selections

B0ToDstarlnuVTight:

- Look for D*-lepton combinations from the **DstarAllLoosePID** and **GoodTracksTight** lists, and restricted to the D0 decay modes:
Kpi, K3pi, Kpipi0, Kspipi.
- $p^*(\text{lepton}) > 1.2 \text{ GeV}$
- D0 mass window $\pm 20 \text{ MeV}$ for Kpi, K3pi, Kspipi and 35 MeV to Kpipi0
- $pT(\text{soft_pi}) > 50 \text{ MeV}$
- $0.5 < p^*(D^*) < 2.5 \text{ GeV}$
- Mass constraint is required for reconstruct pi0 and D0

Selections - kumac

- Angle between thrusts of D^*l and the rest of the event satisfies $\cos(\theta) < 0.85$
- All final charged tracks have $|\eta| < 1.0$ and $|z| < 3$ cm
- raw D^* mass cut ± 17 MeV for $K\pi$, $K3\pi$, $K\pi\pi\pi$ and ± 34 MeV for $K\pi\pi 0$
- raw π^0 mass cut ± 15.75 MeV
- K_s mass cut ± 15 MeV
- Kaon pass **SMSTight** for $K3\pi$ and $K\pi\pi 0$, **notAPion** for $K\pi$

Selections – kumac (cont..)

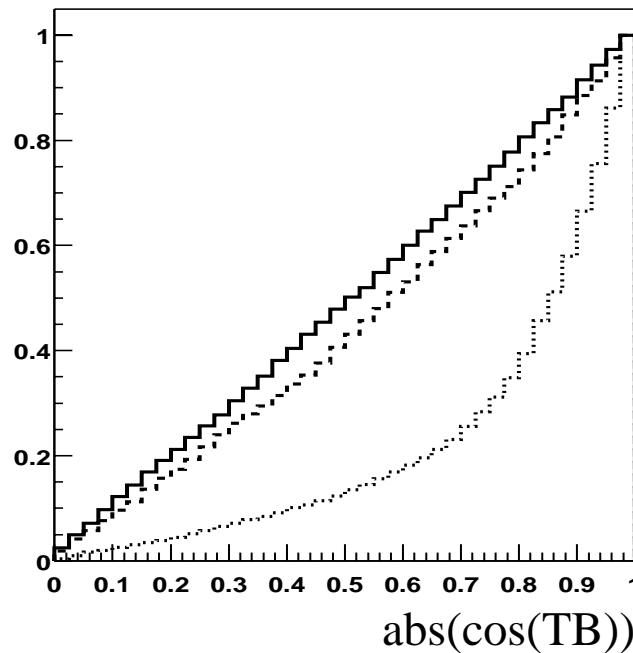
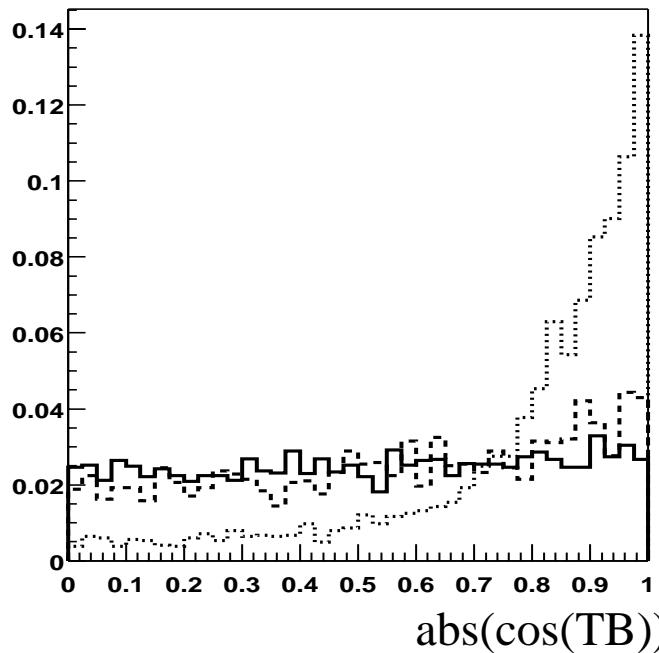
- chi-square prob(D0) > 0.1 %
- chi-square prob(pi0) > 1 %
- chi-square prob(Ks) > 1 %
- chi-square prob(D*l) > 1 %
- Dalitz density > 0.1 (maximum 1.0) for K $\pi\pi$ 0 and K_s $\pi\pi$
- |cos(B-D*l)| < 1.1
- cos(D*-l) < 0
- New D0-pi-lepton refitting algorithm (Gerhard Raven),
sigma(m(D*)-m(D0)) < 2.5 MeV.
- Tag side vertex converges.

Selections – control samples

- Signals electron: candidates that pass the final signal cuts and lepton is **VeryTight** electron
- Signal muon: candidates that pass the final signal cuts and lepton is **VeryTight** muon
- Fake lepton: candidates that pass the final signal cuts and lepton fails **Loose** electron and **Loose** muon
- Uncorrelated lepton: candidates that pass final signal cuts **_after_** lepton is flipped and lepton is **VeryTight** electron or **VeryTight** muon.
(Lots of events in this sample are lost because we did not considered this control sample when creating reduced collections. This sample is not useful for this round of analysis).
- ASCII files contain all these control samples.

Thrust angle

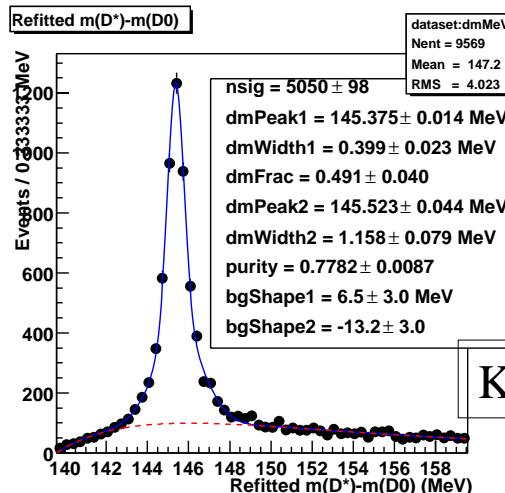
- The angle between the thrusts of D^*l and the rest of the event is a good variable to discriminate signal and continuum.
- Distributions of $\text{abs}(\cos(\text{TB}))$ for true D^*l and D^*h candidates from generic MC and for selected candidates from off-peak data, and the cut efficiencies.



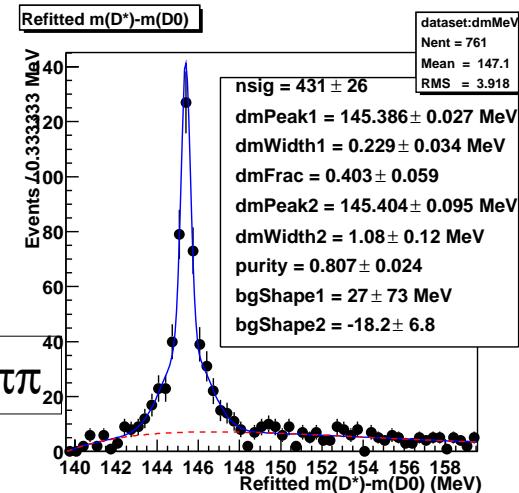
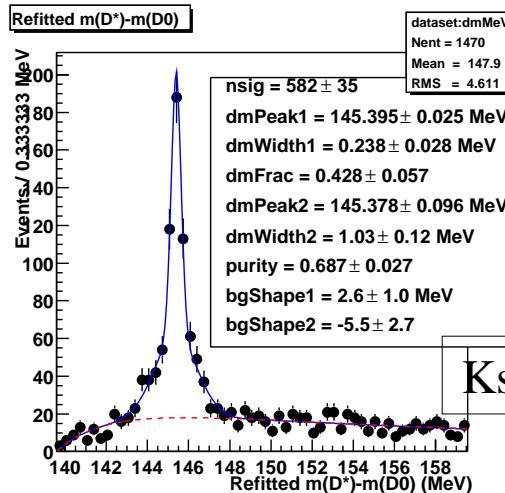
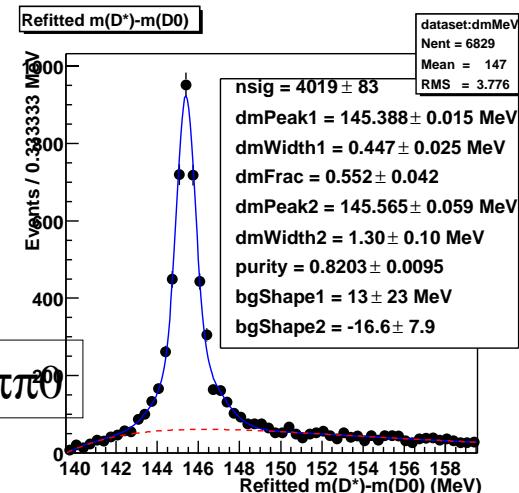
Dalitz cut

- Full on-peak dataset
- $K\pi\pi^0$
“yield”: 5050 \rightarrow 4019
Comb. Frac.
22.2% \rightarrow 18.0%
- $K_S\pi\pi$
“yield”: 582 \rightarrow 431
Comb. Frac.
31.3% \rightarrow 19.3%

Osaka-like

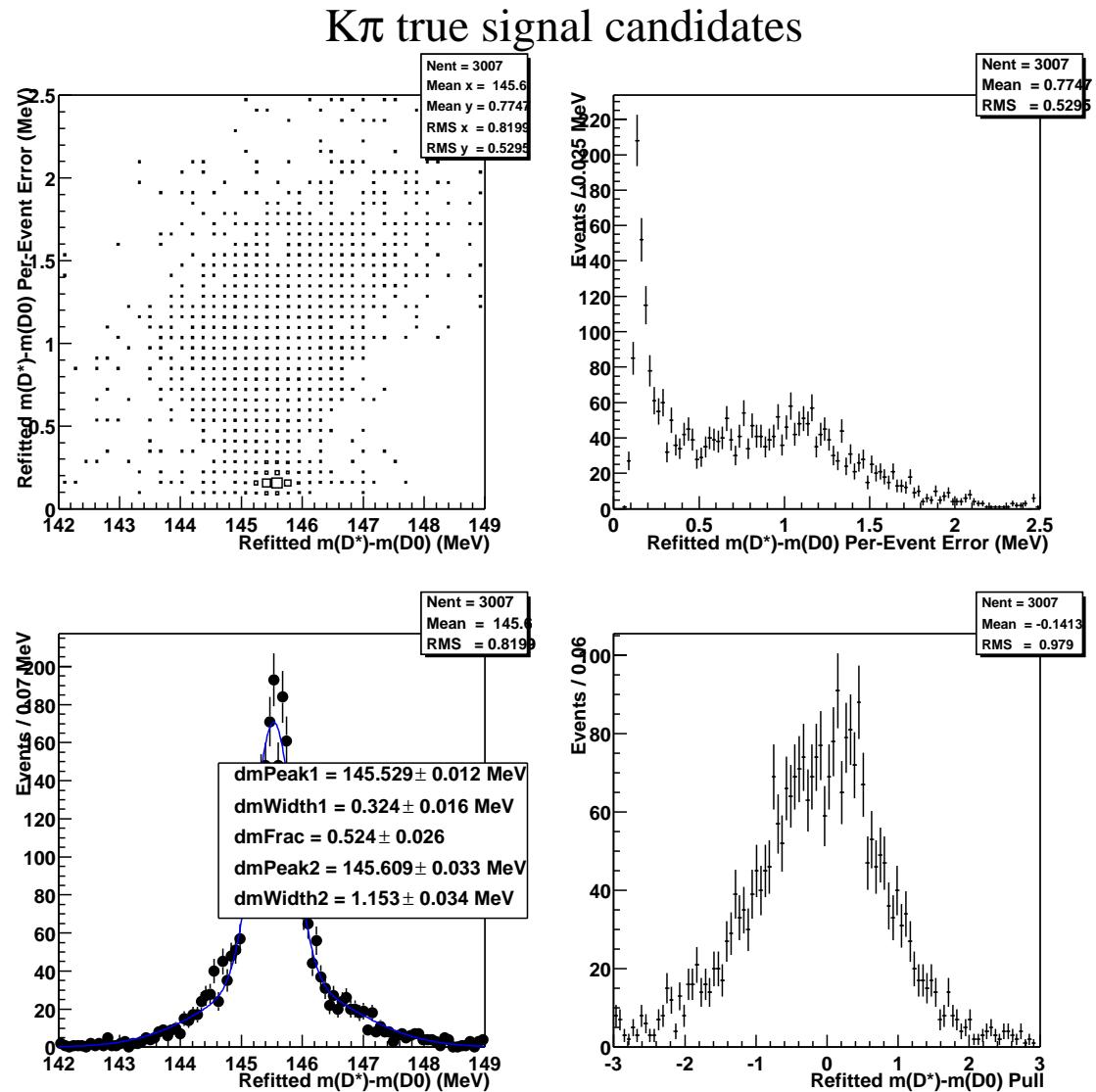


Now



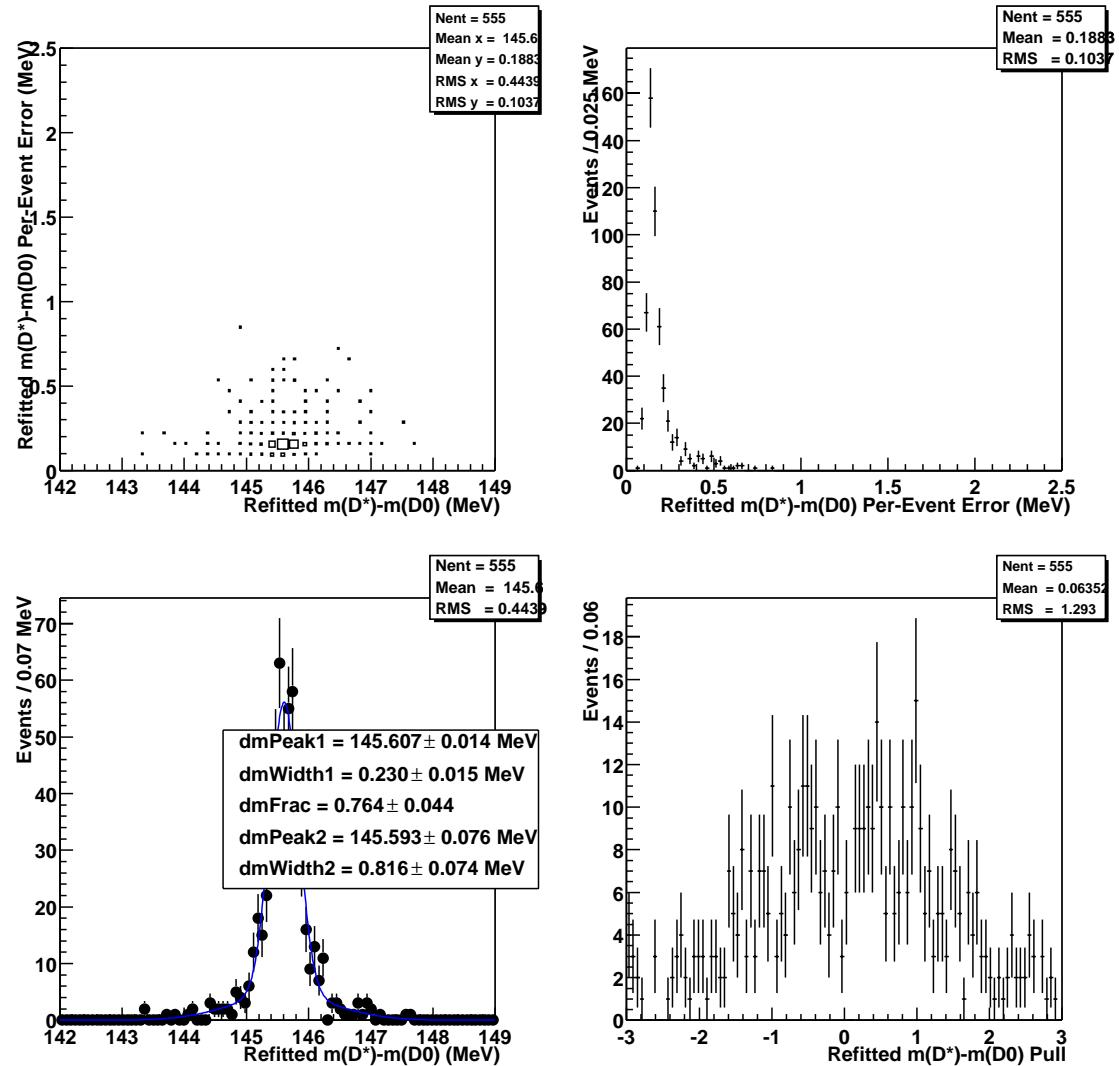
D^0 - π_s -l refit

- $K\pi$ signal, correctly reconstructed.
- Two peaks in errors on Δm
- Two Gaussians to describe Δm peak.
- The width of the wide Gaussian is roughly corresponding to low peak of Δm error.
- The width of the core Gaussian is larger than the high peak of Δm error.



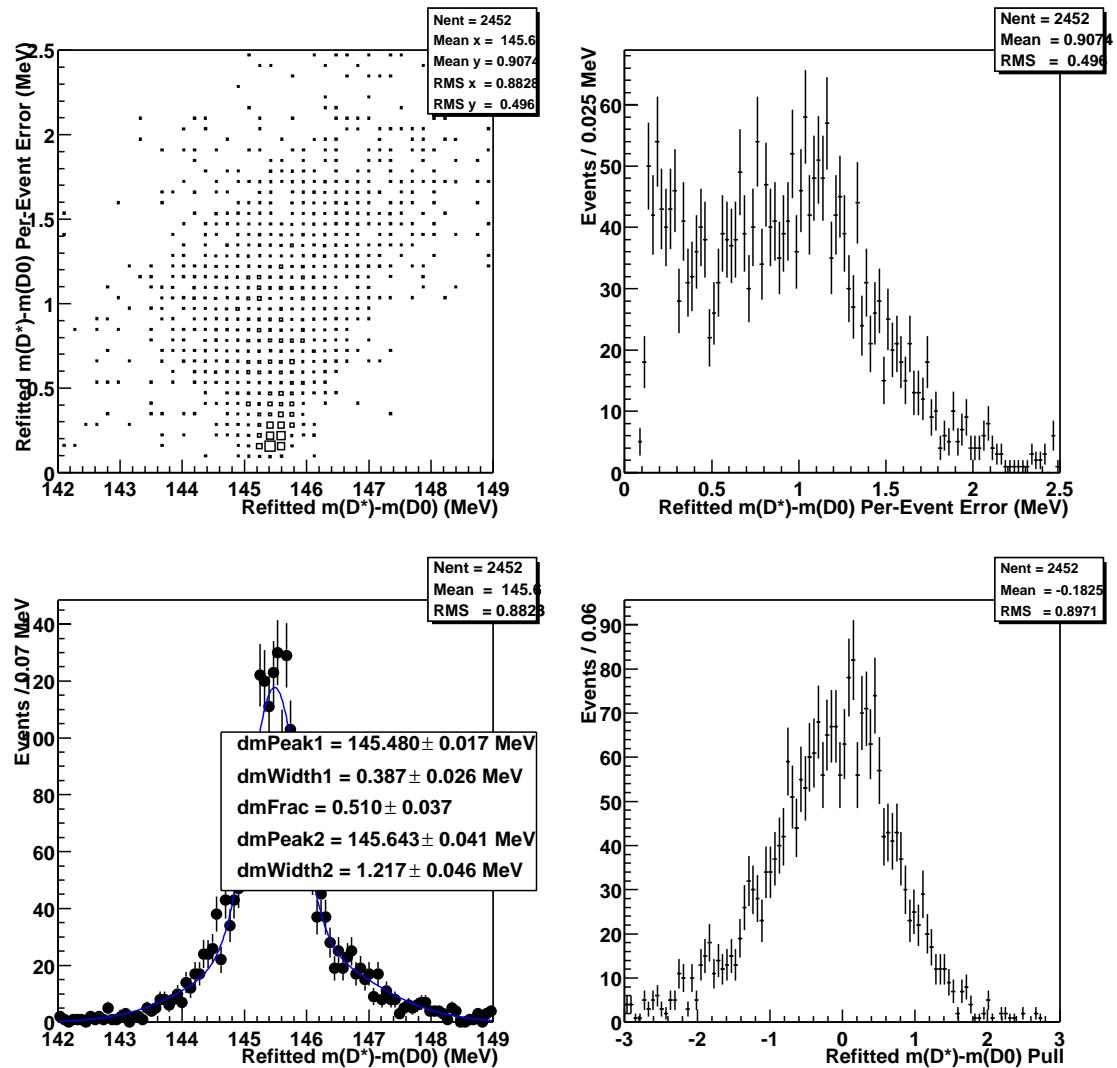
$D^0 - \pi_s$ -l refit

- Plot the sample whose π_s has DCH hits.
- Δm error has single peak at less than 0.2 MeV.
- Δm peak has 76% in core Gaussian with $\sigma = 0.23$ MeV



$D^0-\pi_s$ -l refit

- Plot the sample whose ps has no DCH hits.
- Still looks like two components in error distribution.
- Still need two Gaussians to describe Δm .
- Before understanding the error on Δm , we cannot use per-event error to fit Δm peak.



Production

- Data: 16.67 fb^{-1} on-peak and 2.36 fb^{-1} off-peak data are processed. The ntuples and ascii files are in
`/nfs/farm/babar/AWG2/Breco/production/Dstarlnu/ntuple/reduced-7-2/`
`/nfs/farm/babar/AWG2/Breco/production/Dstarlnu/ascii/reduced-7-2/`
56828 on-peak and 1212 off-peak events in ascii files.
- Signal MC: 8.8.0c, 8.8.0g MC
 - Kpi 22 k; K3pi 32 k; Kpipi0 46 k; Kspipi: 5 k
 - The ntuples and ascii files are in
`/nfs/farm/babar/AWG2/Breco/production/Dstarlnu/ntuple/MCprod-7-2/`
`/nfs/farm/babar/AWG2/Breco/production/Dstarlnu/ascii/MCprod-7-2/`
- Generic MC: 8.8.0c, 8.8.0g MC
 - B0B0bar: 1954.3 k; B+B-: 2003 k
 - The ntuples and ascii files are in the same place as signal MC are.

QA – signal sample

Mode		yield	comb.frac.	S1(MeV)	s2(MeV)	f1
K π	(e,D)	542	3.8%	0.210	0.510	57%
	(e,S)	1964	8.6%	0.267	0.934	31%
	(u,D)	530	3.3%	0.199	0.496	54%
	(u,S)	1866	9.2%	1.000	0.365	61%
K $\pi\pi\pi$	(e,D)	411	11.6%	1.00	0.236	25%
	(e,S)	1503	33.5%	0.90	0.324	64%
	(u,D)	309	10.9%	0.76	0.231	41%
	(u,S)	1393	32.8%	1.00	0.379	56%
K $\pi\pi 0$	(e,D)	440	8.9%	0.273	0.730	51%
	(e,S)	1563	19.7%	0.482	1.34	48%
	(u,D)	416	8.4%	1.00	0.344	28%
	(u,S)	1509	24.4%	1.00	0.423	62%
K $s\pi\pi$	(e,D)	35	13.6%	0.278	0.114	38%
	(e,S)	192	21.9%	1.00	0.252	67%
	(u,D)	45	4.0%	1.00	0.178	36%
	(u,S)	151	20.7%	0.337	1.19	43%

e= electron, u= muon, D= with DCH hits, S= SVT only

QA – fake lepton sample

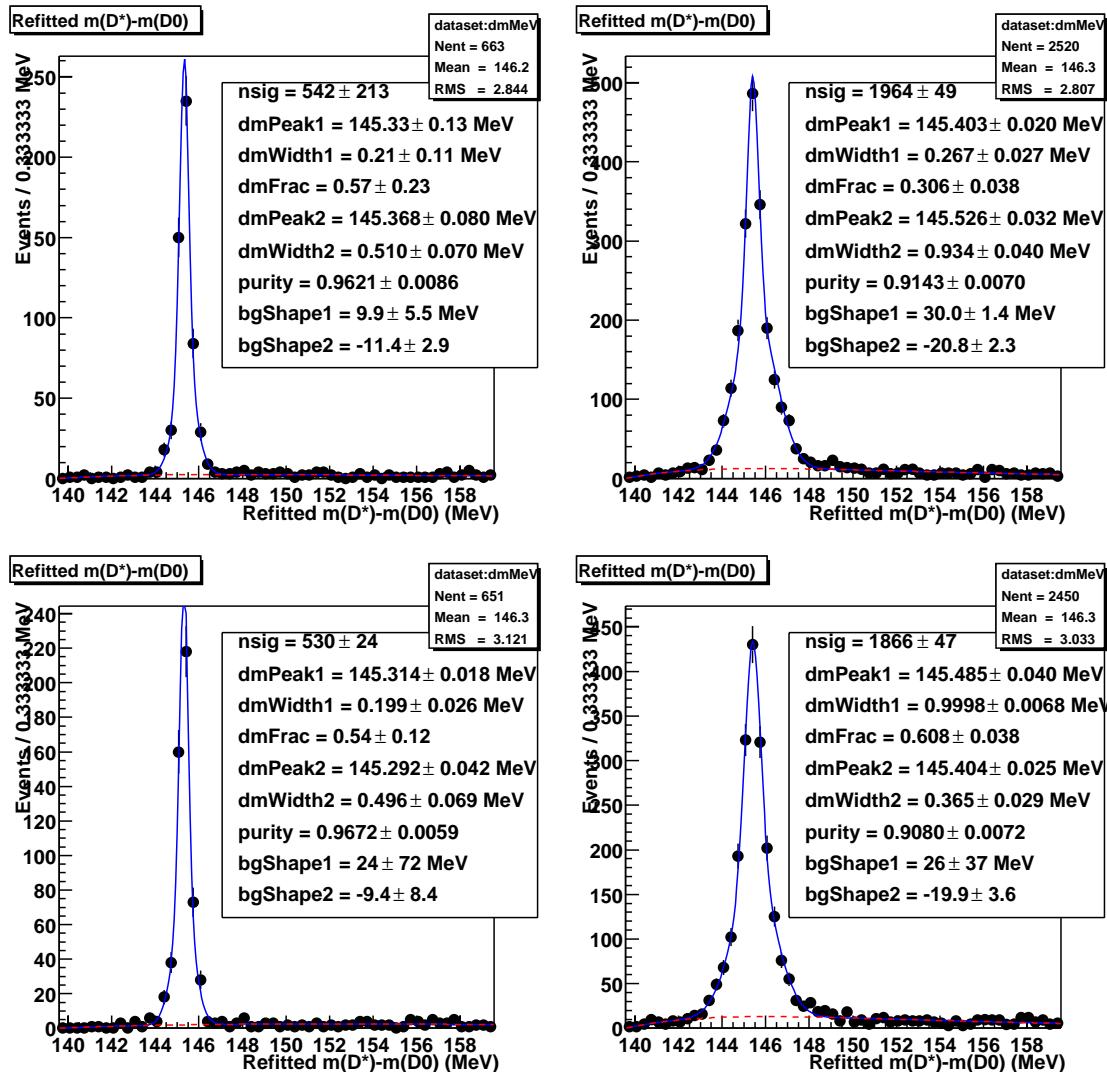
Mode		yield	comb.frac.	S1(MeV)	s2(MeV)	f1	
K π	(D)	895	4.9%	0.484	0.195	53%	
	(S)	2072	12.7%	0.384	1.05	38%	
K $\pi\pi\pi$	(D)	680	15.6%	0.258	2.7	62%	*
	(S)	2124	33.3%	0.515	3.56	40%	*
K $\pi\pi 0$	(D)	739	14.5%	1.00	0.342	27%	
	(S)	1554	36.8%	1.00	0.430	60%	
K $s\pi\pi$	(D)	58	19.4%	0.33	0.182	42%	
	(S)	181	41.9%	1.00	0.65	37%	

D= with Dch hits, S= SVT only.

* Bad fits.

Combinatoric fraction is defined within $143 < D_m < 148$ MeV for SVT only
 $144 < D_m < 147$ MeV for SVT+DCH

Signal- K π

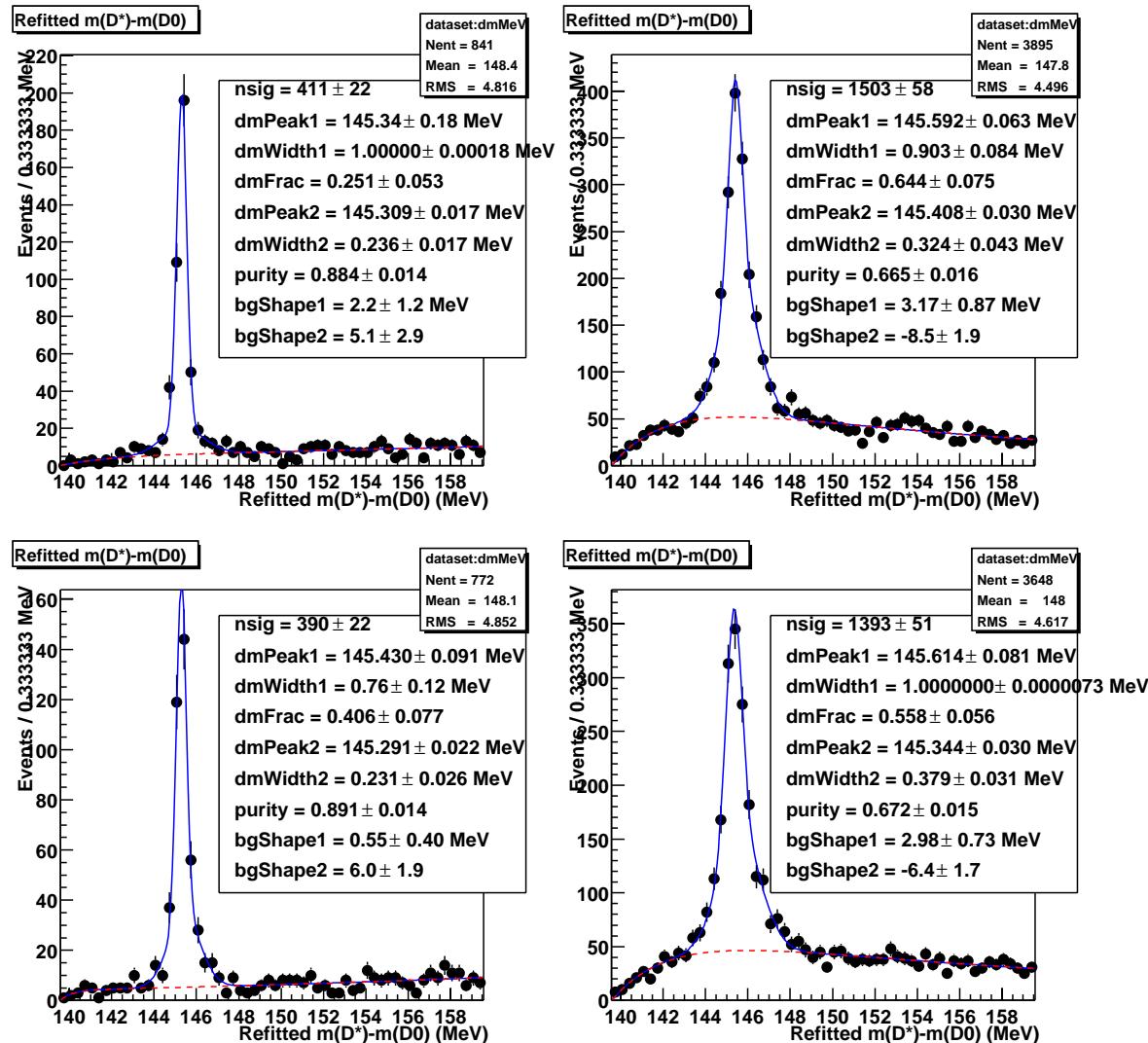


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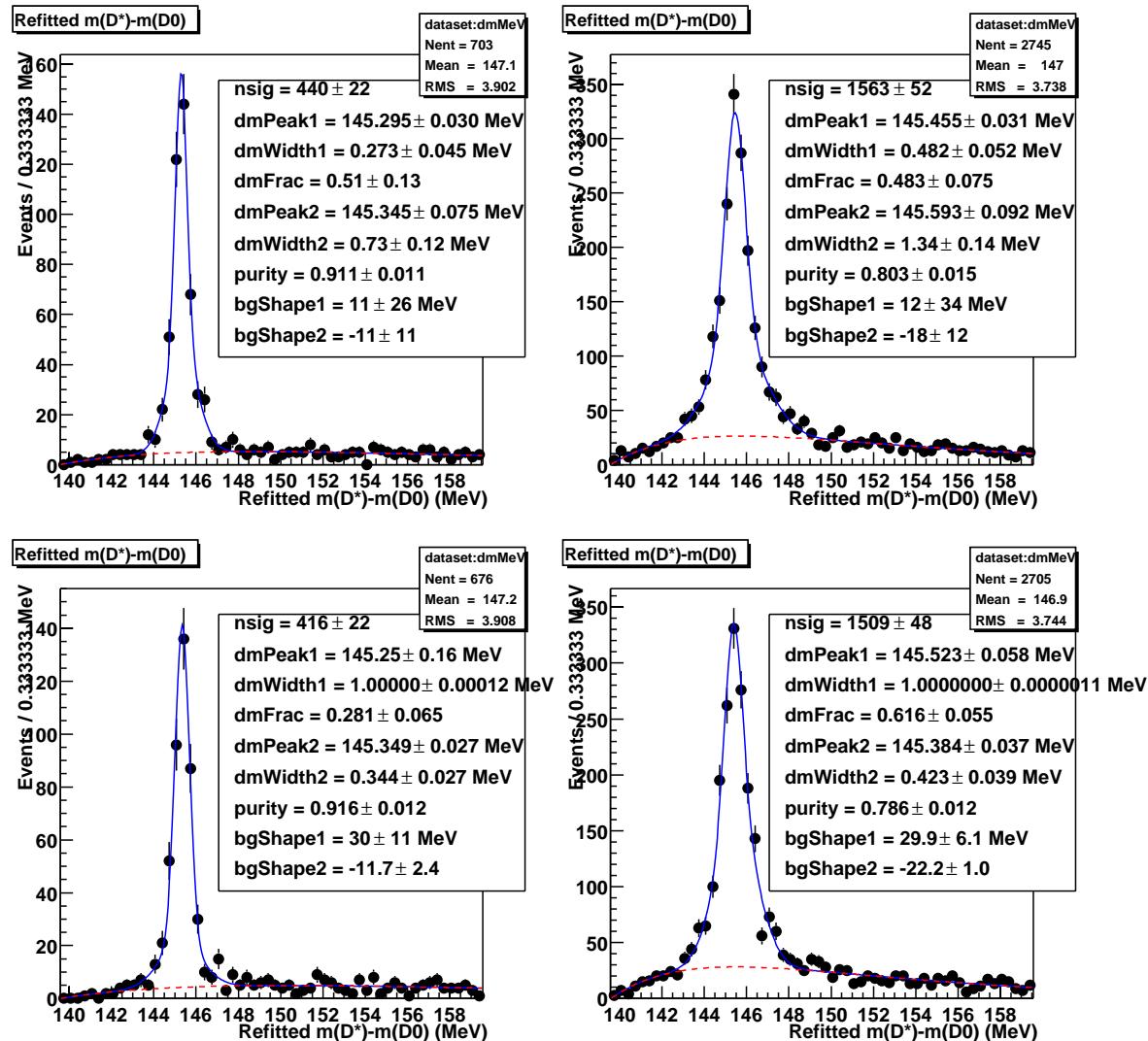
C. Cheng, D*lnu Selections...

15

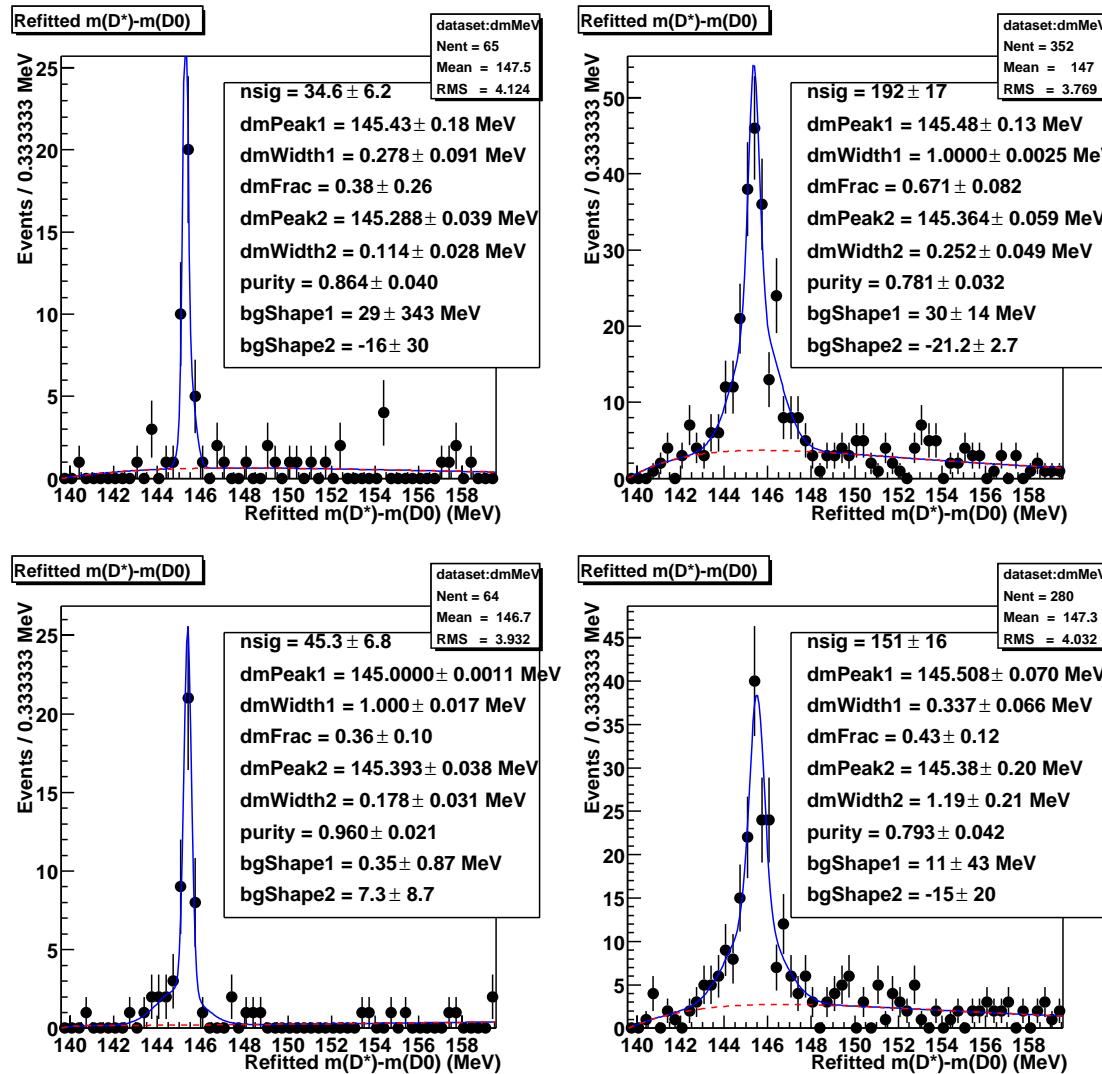
Signal- $K\pi\pi$



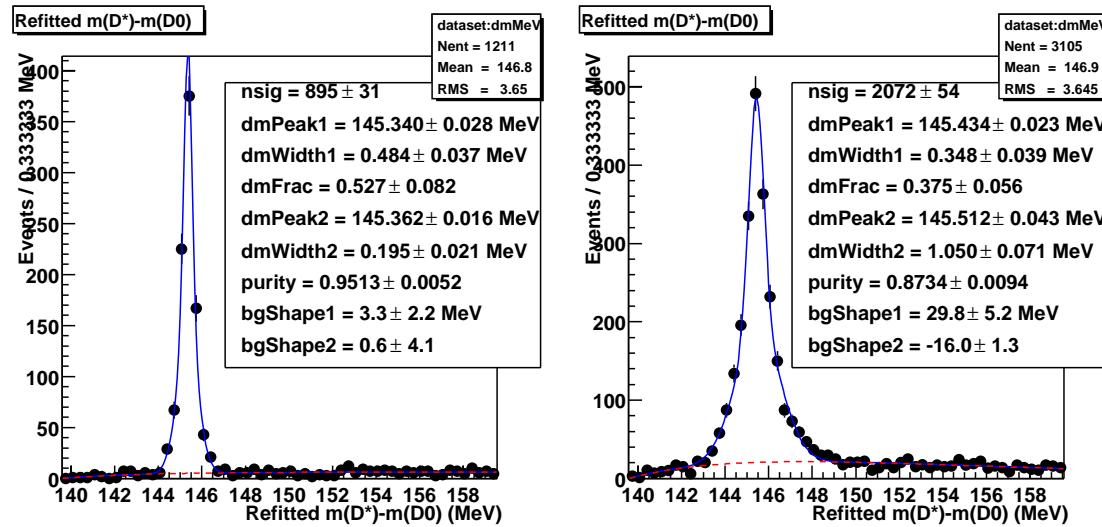
Signal- $K\pi\pi^0$



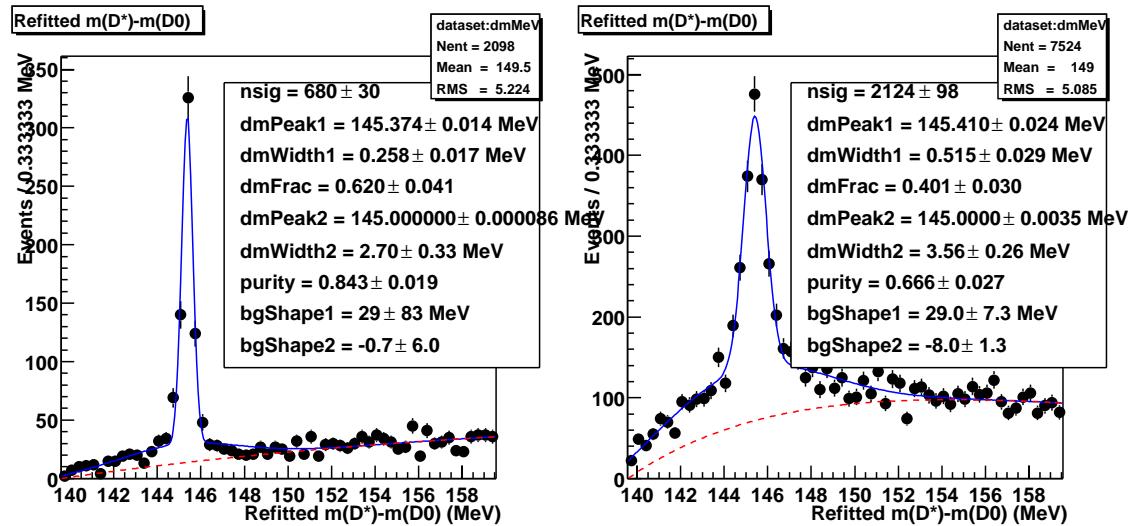
Signal- $K_S\pi\pi$



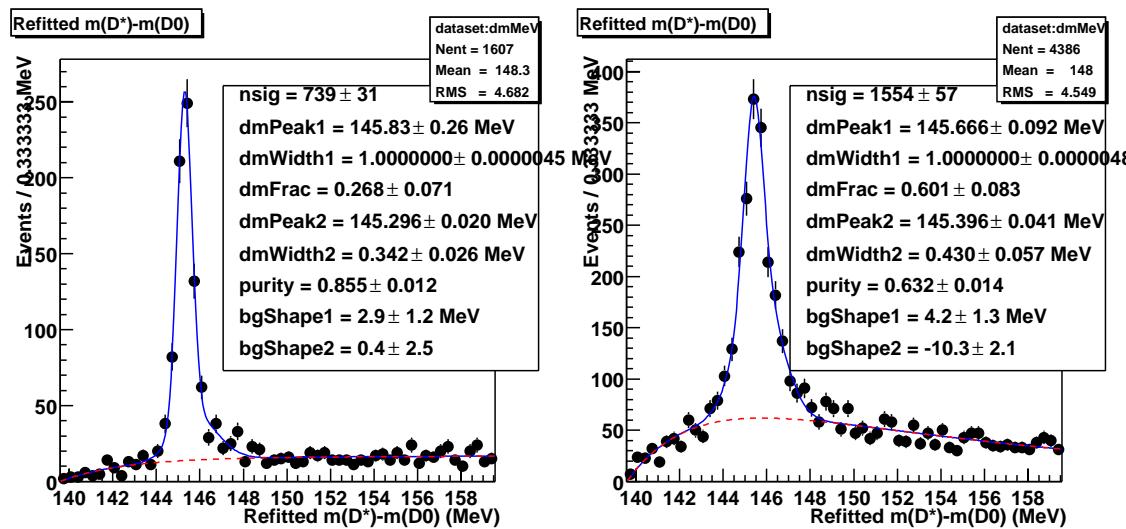
Fake- $K\pi$



Signal- $K\pi\pi\pi$



Signal- $K\pi\pi^0$



Signal- $K_S\pi\pi$

